

## Nature and Properties of Waves

**PS-7 The student will demonstrate an understanding of the nature and properties of mechanical and electromagnetic waves.**

**PS-7.4 Use the formulas  $v = f \lambda$  and  $v = d/t$  to solve problems related to the velocity of waves.**

**Taxonomy Level:** 3.2-C Apply Procedural Knowledge

### Key Concepts:

Wave speed  
Hertz

Frequency  
Wavelength

**Previous/Future knowledge:** In the 8<sup>th</sup> grade students used the formula for average speed,  $v = d/t$ , to solve real-world problems (8-5.2). The students used this formula for finding speed of objects. Students have not previously used these formulas applied to waves. In Physical Science students will use the formulas  $v = f \lambda$  and  $v = d/t$  in different and unfamiliar situations to solve problems relating to all of the variables in the indicator with respect waves.

### It is essential for students to

- Solve problems for any variables in the two equations,  $v = f \lambda$  ( $f = v/\lambda$  or  $\lambda = v/f$ ) and  $v = d/t$  ( $d = v t$  or  $t = d/v$ ), using experimental data.
- Use dimensional analysis to determine the proper units. Examples may include:
  - If distance is given in meters and time is given in seconds, then velocity will be m/s.
  - If frequency is given in hertz and wavelength is given in meters, then velocity will be m/s.
  - If velocity is given in km/h and time is given in hours then distance will be kilometers.
- For math problems involving the wave standard in Physical Science, the quantities are treated as scalar quantities (have size or amount not direction) rather than vector quantities that would involve direction.
  - For the purposes of the wave problems, “v” will represent the scalar quantity speed.
  - For the purposes of the wave problems, “d” will represent the scalar quantity distance.

### It is not essential for students to

- Solve problems involving both formulas - finding a factor in one formula to use in the other formula;
- Solve vector problems (speed and direction) involving waves.

### Assessment Guidelines:

The objective of this indicator is to use the formulas  $v = f \lambda$  and  $v = d/t$  to solve problems, therefore, the primary focus of assessment should be to apply the correct procedure to mathematically determine one of the variables in the formulas  $v = f \lambda$  and  $v = d/t$ . –

In addition to *use*, assessments may require that students

- Use dimensional analysis to determine correct units;
- Recognize symbols and units for wave velocity formulas.